DOCUMENT RESUME

ED 186 487 TM 800 208

AUTHOR Powers, Stephen; Gallas, Edwin J.
TITLE A Comparison of Cognitive Gains of Seventh, Eighth, and Ninth Grade Students across Two Years of Title I.
PUB DATE Apr 80
NOTE 24p.; Paper presented at the Annual Meeting of the American Educational Research Association (64th, Boston, MA, April 7-11, 1980).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Achievement Gains; Educational Testing; Junior High Schools; Longitudinal Studies; *Reading Achievement; *Reading Tests; Statistical Analysis; Test Norms
IDENTIFIERS Comprehensive Tests of Basic Skills; Elementary Secondary Education Act Title I; *Out of Level Testing

ABSTRACT

Test scores for fall and spring administrations for two consecutive years for Elementary and Secondary Education Act (ESEA) Title I students in the Tucson Unified School District are presented and compared. The students were given out-of-level tests: the 138 seventh-grade students and 106 eighth-grade students were given Level 2 of the Comprehensive Tests of Basic Skills (recommended for grades 4.5-6.9) and the 65 ninth-grade students were given Level 3 (recommended for grades 6.5-8.9). Each group took the same test on all four occasions. Data are presented for the total reading score, listing the mean for each group on each occasion in terms of expanded standard scores, normal curve equivalents, and grade equivalents. The appendix also lists means and standard deviations in expanded standard scores for two subscores and the total reading score. The statistical significance of the score changes are presented in terms of Student's t-test. The author discusses the implications of the results with reference to ESEA Title I evaluations. (CTM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED186487

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

A COMPARISON OF COGNITIVE GAINS OF SEVENTH, EIGHTH AND NINTH GRADE STUDENTS ACROSS TWO YEARS OF TITLE I

by

Stephen Powers, PhD

Data Analysis - Edwin J. Gallas

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

S. POWERS

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Department of Research and Evaluation
Director, Barbara S. Prentice, PhD
Tucson Unified School District
Tucson, Arizona

Paper presented at the Annual Meeting of the American Education Research Association, Boston, Massachusetts, April 7-11, 1978.

TM 800

A Comparison of Cognitive Gains
of Seventh, Eighth and Ninth Grade Students
Across Two Years of Title I

Wick (1973, 1977), Horst, Tallmadge and Wood (1975), Tallmadge and Wood (1976), Roberts (1976), and Powers (1977) have advocated out-of-level testing when the level advocated by the publisher does not meet certain criteria of appropriateness, difficulty and suitability. When Title I students are tested out-of-level, often large gains in achievement results. However, in the following years, the gains are often not sustained. If out-of-level reduces measurement error, then the results should be more stable indicators in longitudinal studies.

Some of the results which might be expected in a longitudinal study have been described in the ETS Growth Study (Hilton, 1979; Hilton, Beaton and Bower, 1971). The results of that study indicate that: (1) students achieve at a fairly constant rate from Grades 5 through 12 in various cognitive abilities and (2) the growth curves were of the standard form--ascending, monotonic with constantly decreasing slope. These same characteristics can be observed in the Comprehensive Tests of Basic Skills (CTBS) norms (Growth Charts: Comprehensive Tests of Basic Skills, 1974). Both of these studies suggest that gains of seventh grade students will be greater than eighth grade students. The CTBS norms indicate gains will increase in the ninth grade.

In this study of Title I seventh, eighth and ninth grade cohorts across two years, it was hypothesized that:

(1) The reading achievement gains of the seventh grade cohort will be greater than the eighth grade cohort.

(2) The ninth grade cohort will make greater gains than the eighth grade cohort in reading achievement.

(3) The seventh, eighth and ninth grade cohort's gains will be greater the first year than the second year.

(4) Fall-to-fall achievement of the seventh, eighth and ninth grade cohorts will be similar to the spring-to-spring reading achievement.

Method

The CTBS, Levels 1-4, is a battery of seven tests measuring three basic skills areas: Reading, Language and Mathematics (CTBS/S Test Coordinator's Handbook 1976). The skills areas were classified using Bloom's Taxonomy of Educational Objectives (Appendix A). In the test development, efforts were made to reduce racial and ethnic bias. The K-R 20 reliabilities at each grade level for vocabulary, comprehension and total scores are almost all above .90 with standard errors of measurement from .25 to 1.01 in grade equivalent units. Moreover, it appeared that systematics procedures were followed in test development to ensure content validity. The CTBS Reading Comprehension subtests, Levels 1-4 are composed of 45 items and each item in Levels 1-4 contains multiple choice involving four alternatives. For an outline of the grade levels recommended for administration of the CTBS, refer to Table 1. The CTBS/S Reading Vocabulary subtest is composed of 40 items.

Table 1. CTBS/S Test Levels and Recommended Grades

Test Level	Grades
A	K.0 - 1.3
B	K.6 - 1.9
C	1.6 - 2.9
1	2.5 - 4.9
2	4.5 - 6.9
3	6.5 - 8.9
4	8.5 -12.9

Before the statistical analysis, raw scores were converted to the CTBS Expanded Standard Score Scale. Calculations for the present study were performed with expanded standard scores unless otherwise noted. As the expanded standard scores are a normalized scale with assumed equal intervals, it was believed this metric was more appropriate for statistical analysis. This choice of a metric is in agreement with the technical advice to ESEA Title I evaluators (Tallmadge and Wood 1976). When it was desired to convert an out-of-level test statistic up to the appropriate on-level statistic, the raw scores were converted to expanded standard scores and the desired statistic was computed with expanded standard scores. Then, the appropriate grade level table was referred to, and by means of the appropriate table, the expanded standard score was used to ascertain the grade level raw score, percentile, stanine or grade equivalent.

The CTBS Reading Vocabulary and Reading Comprehension Tests, Form S were administered to a total of 396 seventh grade Title I students, 321 eighth grade Title I students, and 400 ninth grade Title I students in the Tucson Unified School District (TUSD) in the fall of 1977. Overall, the ethnic percentages represented in this study were: 75 percent Mexican-American, 10 percent Black, 6 percent American Indian, and 9 percent Anglo.

In the spring of 1978, fall 1978, and spring 1979 students were retested with the same test. Students in the seventh and eighth grade were tested with the CTBS Reading Vocabulary and Reading Comprehension Tests, Form S, Level 2, and ninth and tenth grade students were tested with Level 3. This analysis is based on only those students who were tested on all four occasions from fall 1977 to spring 1979.

Results

In the fall of 1977, 1117 Title I students in Grades 7-9 were administered the CTBS Reading Vocabulary and Reading Comprehension Tests (396 seventh grade students, 321 eighth grade students and 400 ninth grade students in the TUSD). Only those students tested in the fall 1977, spring 1978, fall 1978 and spring 1979 were included in this analysis, and this reduced the size of the three initial cohorts to 138 seventh grade students, 106 eighth grade students and 65 ninth grade students. These numbers represented 35 percent of the seventh grade cohort, 33 percent of eighth grade cohort, and 16 percent of the ninth grade cohort.

Factors contributing to the attrition of Title I students were investigated (Powers, 1979). The following is a list of contributing factors:

(1) Adaptive Education students were no longer allowed to participate in Title I.

(2) Students dropped or withdrew from school.

(3) A Title I school was closed because of a court order.

(4) Students were transferred out of Title I because they no longer needed Title I services.

(5) Students were no longer in Title I at the high school level because of scheduling problems.

In summary, many decisions beyond the control of local Title I personnel contributed to the attrition of students from the program.

To estimate the possible bias introduced into the data by the attrition, t-tests were computed between the means of the original group not included in the study and the means of the groups remaining in the study using the fall 1977 test results. The mean of seventh grade students not included in the study was significantly higher than those in the study,

$t(394) = 3.35$, $p < .01$, and the mean of the ninth grade students not included in the study were also higher than those in the study, $t(398) = 3.65$, $p < .01$. The mean difference for the two eighth grade groups was not significant, $t(319) = .35$. These results suggest that the seventh and ninth grade cohorts represented lower-achieving students of the original groups tested in the fall of 1977, but the eighth grade cohort was not significantly different from the eighth grade students not in the study.

It was hypothesized that the seventh grade cohort would make greater gains than the eighth grade cohort. It was further hypothesized that the eighth grade cohort would make greater gains than the ninth grade cohort. Descriptive statistics are presented in Table 2. Complete descriptive statistics for the seventh, eighth and ninth grade cohorts are given in Appendices B and D.

The CTBS Reading Vocabulary scores were combined with the CTBS Reading Comprehension scores to obtain a CTBS Total Reading Test score for each Title I student. The total test score was then converted into CTBS Expanded Standard Scores. Most of the data analysis was conducted with CTBS Expanded Standard Scores because of their suitability for longitudinal research when the level of the test is changed and because students in this study were tested one level below that recommended by the test publisher. The data is also presented in NCEs and GEs.

Table 2. Comparison of Gains of the First and Second Years* as Measured in GEs, NCEs, and Expanded Standard Scores

Grade	Scale	1977-78 Fall	1977-78 Spring	1977-78 Diff	1978-79 Fall	1978-79 Spring	1978-79 Diff
7	GE	3.4	4.3	.9	4.7	5.2	.5
	NCE	21.6	27.2	5.6	28.0	29.3	1.3
	SS	365.9	405.4	39.5	419.9	439.6	19.7
8	GE	3.9	4.9	1.0	4.9	5.3	.4
	NCE	22.0	26.8	4.6	25.6	25.7	3.5
	SS	390.2	428.6	38.4	427.0	442.9	15.9
9	GE	4.3	5.3	1.0	5.4	6.1	.7
	NCE	21.2	25.4	4.2	23.7	23.5	-.2
	SS	407.1	441.9	34.8	445.6	471.8	26.2

* Seventh Grade N = 138
Eighth Grade N = 106
Ninth Grade N = 65

In order to test the first and second hypotheses, the regression line of the seventh grade cohort was compared with the regression line of the eighth grade cohort. This was done for the first year of the study, and then for the second year of the study. Similarly the regression line of the eighth grade cohort was compared with the regression line of the ninth grade cohort for the first and second year. The procedures for these tests of significance of interaction are outlined in Kerlinger and Pedhazur (1973, p. 245). None of the comparisons were significant. These results were evidence of lack of significant interaction between group membership in the cohorts and initial achievement level. Figure 1 presents a graph of the reading achievement of the three cohorts measured in CTBS Expanded Standard Scores. This visual evidence corroborates the findings of the tests of significance of interaction.

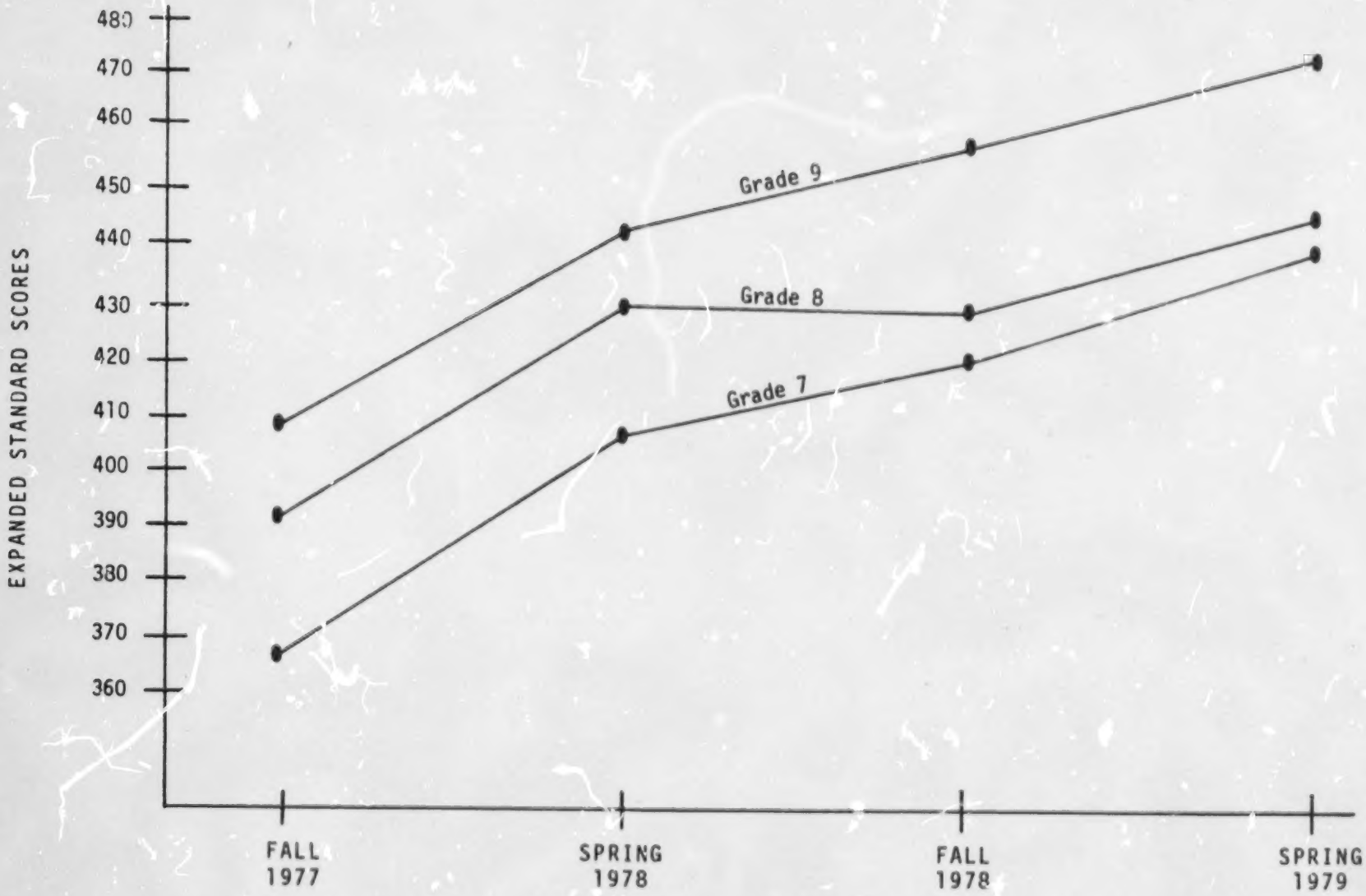

Figure 1. Reading achievement of Title I seventh, eighth and ninth grade students across two years as measured in CTBS Expanded Standard Scores

It was hypothesized also that the seventh, eighth and ninth grade cohorts would make greater gains the first year than the second year. T-tests for dependent samples were computed with CTBS Expanded Standard Scores and NCEs. Three t-tests were computed for each cohort using CTBS Expanded Standard Scores: fall 1977 to spring 1978, spring 1978 to fall 1978 and fall 1978 to spring 1979. Three more t-tests were computed for each cohort using NCEs. Table 3 presents the t-values for these comparisons.

Table 3. T-Tests Comparing Fall 1977 - Spring 1978 Means, Spring 1978 - Fall 1978 Means and Fall 1978 - Spring 1979 Means as Measured in CTBS Expanded Standard Scores and Normal Curve Equivalents

Cohort	Scale	df	FIRST YEAR Fall 77-Spring 78 t-value	SUMMER Spring 78-Fall 78 t-value	SECOND YEAR Fall 78-Spring 79 t-value
7	SS	137	12.53**	5.59**	8.33**
	NCE	137	8.38**	1.89	1.72
8	SS	105	13.08**	- .36	3.62**
	NCE	105	8.04**	-1.50	.20
9	SS	64	7.59**	.85	6.38**
	NCE	64	4.20**	-2.23*	.01

* $p < .05$
** $p < .01$

The seventh grade cohort made significant gains the first year, across the summer and the second year when measured in Expanded Standard Scores. When measured in NCEs which reflect CTBS national percentile standing, only the first year were there significant gains. See Figure 2 for a visual presentation of the NCE gains of the seventh, eighth and ninth grade cohorts.

The eighth grade showed significant gains in Expanded Standard Scores the first and second years of the study, but across the summer there were no significant changes. When the eighth grade cohort's scores were converted to NCEs only the first year showed significant gains. The summer and the second year did not show significant changes.

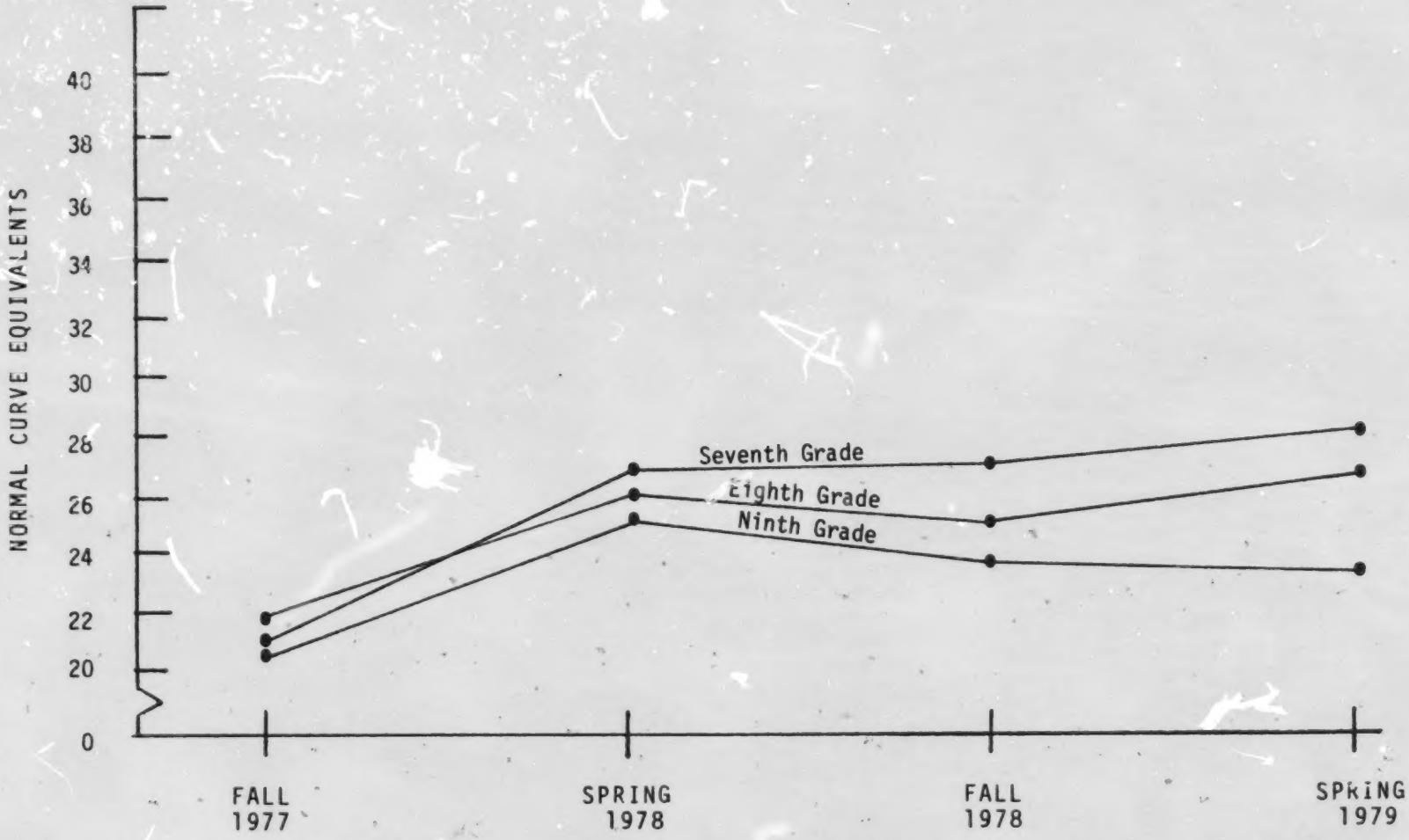

Figure 2. Reading achievement of Title I seventh, eighth and ninth grade students across two years as measured in Normal Curve Equivalents.

The GE gains the first year were very large. The number of months from fall-to-spring testing was seven. Therefore the average GE gains the first year for the seventh grade cohort were 1.3; for the eighth and ninth grade cohort the average GE gains were 1.4. These gains for eighth and ninth grade cohorts are often interpreted as a month and one-fourth GEs for each month in the program.

The remarkably large gains of the first year were matched by small gains the second year when measured in GEs. The average month-for-month gains the second year were the following:

(1) Seventh grade cohort = .7 of one GE
(2) Eighth grade cohort = .6 of one GE
(3) Ninth grade cohort = 1.0 GE

(Refer to Table 2.)

The ninth grade cohort, similar to the eighth grade cohort, demonstrated significant gains the first year and the second year when measured in Expanded Standard Scores, but across the summer months there were no significant changes. When the ninth grade cohort's scores were converted to NCEs, a significant gain was shown the first year and a significant loss was indicated over the summer. The second year of study the ninth grade cohort did not make significant changes from pretest to posttest as measured in NCEs.

From an inspection of Table 2, there is a consistent pattern of mean differences for each cohort, whether measured in GEs, NCEs, or Expanded Standard Scores. The gains the first year were greater than the gains the second year. Although the gains did not reach statistical significance, the pattern is obvious. Three independent findings of the same nature occurring across two years are important findings although not statistically significant.

The last hypothesis was that the fall-to-fall achievement of the seventh, eighth and ninth grade cohorts will be similar to the spring-to-spring reading achievement (refer to Table 4). The seventh grade cohorts made signif-

icant gains whether the gains were compared fall to fall or spring to spring. The significant gains also occurred whether the seventh grade cohort's gains were measured in CTBS Expanded Standard Scores or NCEs. The eighth grade cohort's gains fall to fall and spring to spring were significant when measured in Expanded Standard Scores. When measured in NCEs, the gains were significant from fall to fall, but not significant from spring to spring.

Table 4. T-Test Comparisons of Fall 1977 and Fall 1978 Means and Spring 1978 and Spring 1979 Means on the CTBS Total Reading Test

Cohort	Scale	Fall 1977 - Fall 1978 $\bar{x}_1$	$\bar{x}_2$	Diff	t	Spring 1978 - Spring 1979 $\bar{x}_1$	$\bar{x}_2$	Diff	t
7	SS	365.9	419.9	54.0	16.58**	405.4	439.6	34.2	12.74**
	NCE	21.6	28.0	6.4	10.19**	27.2	29.3	2.1	3.39**
8	SS	390.2	427.0	36.8	8.07**	428.6	442.9	14.3	3.84**
	NCE	22.0	25.6	3.6	3.88**	26.8	25.7	- 1.1	- 1.62
9	SS	407.1	445.6	38.5	6.94**	441.9	471.8	29.9	6.59**
	NCE	21.2	23.7	2.5	1.82	25.4	23.5	- 1.9	- 2.35***

* Seventh Grade Cohort N = 138, Eighth Grade Cohort N = 106, Ninth Grade Cohort N = 65
** $p < .01$
*** $p < .05$

The ninth grade cohort gains were significant fall to fall and spring to spring when CTBS Expanded Standard Scores are used. When measured on the NCE scale, the fall-to-fall mean difference was not significant, and the spring-to-spring mean differences were significant indicating the achievement of the ninth grade cohort dropped significantly in relation to the CTBS norms.

In summary, the fall-to-fall gains were greater than the spring-to-spring gains whether measured in Expanded Standard Scores or NCEs and whether the seventh, eighth or ninth grade cohorts were involved in the analysis.

Discussion

At the beginning of this study groups that dropped out of the longitudinal study were compared with the cohorts which remained in the study. Lower-achieving seventh and ninth grade students remained in the study and composed the seventh and ninth grade cohorts. The group that dropped out of the eighth grade Title I cohort was not significantly different from the group that composed the final eighth grade cohort. These comparisons were made on the basis of initial CTBS Total Reading Test scores in the fall of 1977.

The seventh grade, eighth grade and ninth grade cohorts were at 8.9 percentile, 9.2 percentile and 8.6 percentile respectively in the fall of 1977. Since the three cohorts were essentially at the ninth percentile at the beginning of this study, it seemed appropriate, in retrospect, that students were tested out of level. It would be expected that testing Title I students who are initially achieving at the ninth percentile would reduce somewhat the measurement error that would be present when students are tested with an inordinately difficult test.

When students were tested fall to spring the first year and fall to spring the second year, a consistent pattern occurred. Some changes were statistically significant; others were not, but the pattern was consistent: greater gains the first year and smaller gains the second year. This pattern of achievement occurred whether students were measured in GEs, Expanded Standard Scores or NCEs. One might hypothesize that a regression effect caused the gains the first year. However, students were selected for Title I based on scores on a standardized test administered two years before the fall of 1977.

These results suggest weaknesses in evaluation practices when a group of students is tested fall to spring without any followup study. Although students display an initial surge of achievement the first year, that rate of achievement may not be sustained the following year.

Another pattern emerged from this study: students who were tested fall to fall displayed greater gains than students tested spring to spring. This pattern occurred when students were measured with Expanded Standard Scores and NCEs. One of the implications of these findings is that a fall-to-fall evaluation design is more likely to provide positive evidence of program effectiveness than spring-to-spring evaluation because the fall-to-fall gains are greater. Of course the one year fall-to-spring evaluation provides the greatest gains. With the new interest in longitudinal evaluations and sustained gains, more research will undoubtedly uncover weaknesses in past evaluation practices.

References

Growth Charts: Comprehensive Tests of Basic Skills: CTB/McGraw-Hill, Del Monte Research Park, Monterey, California, 1974.

Hilton, Thomas L. ETS study of academic prediction and growth. In John E. Milholland (Ed.), New Directions for Testing and Measurement: Insights from Large-Scale Surveys. San Francisco: Jossey-Bass, Inc., Number 2, 1979, 27-44.

Hilton, T. L., Beaton, A. E., and Bower, C. P. Stability and Instability in Academic Growth - A Compilation of Longitudinal Data. Final Report to USOE, Research No. 0-0140. Princeton, N. J.: Educational Testing Service, 1971 (ERIC Document Reproduction Service No. ED 065 514).

Kerlinger, F. N., and Redhazur, E. J. Multiple Regression in Behavioral Research. Holt, New York, 1973.

Powers, S. A Comparison of ESEA Title I Student Gains in a Fall-to-Spring and Fall-to-Fall Out-of-Level Testing Schedule. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, California, April 8-12, 1979.

Roberts, A. O. H. Out-of-Level Testing: ESEA Title I Evaluation and Reporting System, Technical Paper No. 6. RMC Research Corporation, Mountain View, California, October 1976.

Tallmadge, G. K., and Wood, C. T. User's Guide: ESEA Title I Evaluation and Reporting System. RMC Research Corporation, Mountain View, California December 1976.

Wick, J. W. Educational Measurement, Merrill Publishing Company, Columbus, Ohio, 1973.

Wick, J. W. A report on individualized testing in Chicago. Putting Current Ideas in Measurement to Work in the Schools. Proceedings from the Thirteenth Annual Houghton-Mifflin Measurement Conference, Iowa City, Iowa, April 26-27, 1977.

Appendix A

Process Categories Adapted from Bloom's Taxonomy Used for Classifying Items in the Comprehensive Tests of Basic Skills, Reading Comprehension Test

Recognition

Recognize, or recall and apply, facts, theories, laws, concepts, structures, methods, and formulas previously learned.

Translation

Transform concepts, terms, and symbols into equivalent forms, as in interpreting graphically presented data.

Interpretation

Understand facts and concepts in, and make inferences from, written material. Associate data and ideas and comprehend relationships stated or implied in material. Summarize and restate significant themes or concepts.

Application

Apply prior knowledge of facts or techniques to answer questions and solve problems. Utilize previously learned research skills and techniques to determine function or meaning of new material.

Analysis

Apply formal logic to the breakdown of material into organizational patterns or principal components; the determination of validity, bias, tone; the hierarchical arrangement of facts; the cognizance of total problems.

Appendix B

Descriptive statistics of seventh grade Title I students participating in a two-year study of reading achievement as measured by the Comprehensive Tests of Basic Skills, Reading Vocabulary and Reading Comprehension subtests*

	Vocabulary		Comprehension		Total	
Year**	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Fall 1977	372.3	46.1	375.8	50.7	365.9	42.1
Spring 1978	403.5	46.8	421.1	55.8	405.4	47.6
Fall 1978	419.7	51.9	434.8	58.1	419.9	50.4
Spring 1979	437.7	49.3	456.4	61.5	439.6	50.6

* Number of participating students was 138.

** Only Title I students who were tested in fall 1977, spring 1978, fall 1978 and spring 1979 were included.

Appendix C

Descriptive statistics of eighth grade Title I students participating in a two-year study of reading achievement as measured by the Comprehensive Tests of Basic Skills, Reading Vocabulary and Reading Comprehension subtests.*

Year**	Vocabulary $\bar{x}$	Vocabulary SD	Comprehension $\bar{x}$	Comprehension SD	Total $\bar{x}$	Total SD
Fall 1977	389.6	50.4	405.7	57.2	390.2	48.9
Spring 1978	422.4	46.7	449.4	54.5	428.6	45.7
Fall 1978	431.4	50.1	429.7	64.3	427.0	50.7
Spring 1979	438.7	57.3	453.8	67.2	442.9	57.6

* Number of participating students was 106.

** Only Title I students who were tested in fall 1977, spring 1978, fall 1978 and spring 1979 were included.

Appendix D

Descriptive Statistics of Ninth Grade Title I Students Participating in a Two-Year Study of Reading Achievement as Measured by the Comprehensive Tests of Basic Skills, Reading Vocabulary and Reading Comprehension Subtests*

Year**	Vocabulary $\bar{x}$	Vocabulary SD	Comprehensive $\bar{x}$	Comprehensive SD	Total $\bar{x}$	Total SD
Fall 1977	405.7	54.9	416.3	58.7	407.1	49.4
Spring 1978	439.7	53.9	451.6	41.1	441.9	44.3
Fall 1978	439.8	62.4	456.1	59.6	445.6	56.9
Spring 1979	468.4	62.6	480.6	59.8	471.8	55.4

* Seventh Grade N = 138
  Eighth Grade N = 106
  Ninth Grade N = 65